Report Date: 03/29/2012

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Regional Payroll Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Employee Name	Fiscal Year	Pay Period	Payroll Hours	Payroll Costs
TRUONO-WIGGETT, MARISSA	2010	19	1.00	67.64
	2011	03	2.00	135.81
		12	3.50	237.67
		17	2.50	169.76
	2012	03	1.00	68.02
			30.00	$1,995.07
WALL, STEVEN	2011	02	14.00	725.96
			14.00	$725.96
WILSON, ERIC	2010	12	1.00	76.33
	2011	18	1.00	78.77
		25	9.00	728.68
		26	1.00	80.97
	2012	02	2.00	162.18
		03	3.00	241.38
			17.00	$1,368.31
Total Regional Payroll Costs			647.18	$44,112.16

Report Date: 03/29/2012

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Headquarters Payroll Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Employee Name	Fiscal Year	Pay Period	Payroll Hours	Payroll Costs
PRINCE, GEORGE R.	2011	03	44.00	3,629.74
			44.00	$3,629.74
Total Headquarters Payroll Costs			44.00	$3,629.74

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Regional Travel Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Traveler/Vendor Name	Travel Number	Treasury Schedule	Treasury Schedule Date	Travel Costs
CHONG, MARGARET	TM0436468	06178	06/29/2006	217.50
				$217.50
DALOIA, JAMES J.	0QLKIP	10161	06/14/2010	273.11
	0QZ5IY	10272	10/01/2010	285.51
	0R2ZC5	10320	11/18/2010	416.50
				$975.12
DAVIS, ELIZABETH	0QLU3B	10172	06/23/2010	194.50
				$194.50
LEUNG, CHRISTINA	0R2QD9	10363	01/03/2011	557.00
				$557.00
NACE, CHARLES G., JR.	0QLBDQ	10180	07/01/2010	200.50
				$200.50
SOLECKI, MICHAEL F.	0R07EA	10313	11/12/2010	451.69
				$451.69
SOLECKI, MICHAEL F.	0QLSGW	10167	06/18/2010	224.11
	0QX0IV	10294	10/25/2010	519.74
				$743.85
Total Regional Travel Costs				$3,340.16

Report Date: 03/29/2012

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Headquarters Travel Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Traveler/Vendor Name	Travel Number	Treasury Schedule	Treasury Schedule Date	Travel Costs
PRINCE, GEORGE R.	0R1J1J	10327	11/26/2010	1,174.36
				$1,174.36
Total Headquarters Travel Costs				$1,174.36

Report Date: 03/29/2012

Certified By Financial Management Office

Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY (EMSL)

Contractor Name: LOCKHEED MARTIN

EPA Contract Number: EPD05088

Project Officer(s): JOHNSON, KIMBERLEY

Dates of Service: From: 03/22/2010 To: 09/11/2010

Summary of Service: REMOTE SENSING SUPPORT/EPIC(REDI)

Total Costs: $6,039.92

Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number	and Date	Site Amount	Annual Allocation
74	04/20/2010	87,667.93	10705	05/21/2010	533.98	9.17
75	05/23/2010	108,158.31	00816	06/25/2010	2,754.42	47.30
76	06/20/2010	87,015.46	00938	08/03/2010	818.07	14.05
77	07/19/2010	111,662.65	00991	08/18/2010	754.13	12.95
78	08/23/2010	127,555.30	00A96	09/17/2010	603.19	10.36
79	09/20/2010	146,965.72	01055	10/19/2010	474.16	8.14
				Total:	$5,937.95	$101.97

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY (EMSL)

Contractor Name: LOCKHEED MARTIN

EPA Contract Number: EPD05088

Project Officer(s): JOHNSON, KIMBERLEY

Dates of Service: From: 03/22/2010 To: 09/11/2010

Summary of Service: REMOTE SENSING SUPPORT/EPIC(REDI)

Total Costs: $6,039.92

Voucher Number	Schedule Number	Rate Type	Annual Allocation Rate
74	10705	Provisional	0.017173
75	00816	Provisional	0.017173
76	00938	Provisional	0.017173
77	00991	Provisional	0.017173
78	00A96	Provisional	0.017173
79	01055	Provisional	0.017173

Report Date: 03/29/2012

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

OTHER EXPENDITURES (OTH)

Contractor Name: LOCKHEED MARTIN SERVICES

EPA Contract Number: EPW09031

Project Officer(s): BURCHETTE, SELLA
UR, NANCY

Dates of Service: From: 11/14/2010 To: 05/22/2011

Summary of Service: SCIENTIFIC,ENGINEERING,RESPONSE,ANALYTIC

Total Costs: $10,853.43

Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number	and Date	Site Amount
BVN0013	11/18/2010	1,045,931.82	01264	12/27/2010	6,401.13
BVN0014	01/03/2011	1,121,272.44	11374	01/28/2011	10,274.94
BVN0014	01/03/2011	1,121,272.44	01374	01/28/2011	-6,401.13
BVN0015	01/28/2011	1,984,673.55	11472	02/25/2011	552.04
BVN0019	05/25/2011	1,534,469.69	11883	06/21/2011	26.45
				Total:	$10,853.43

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

SUPERFUND TECH ASSESSMENT AND RESPONSE TEAM

Contractor Name: ROY F WESTON, INC.

EPA Contract Number: 68-W0-0113

Project Officer(s): ENG, HELEN

Dates of Service: From: 03/01/2006 To: 06/30/2006

Summary of Service: S/F TECH ASSESSMENT&RESPONSE TEAM (REDI)

Total Costs: $31,786.69

Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number	and Date	Site Amount	Annual Allocation
82-LOT0011	04/14/2006	239,344.81	06445	05/12/2006	943.48	273.87
84-LOT0011	05/19/2006	187,595.45	06513	06/14/2006	244.97	71.11
88-LOT0011	07/24/2006	222,824.49	06654	08/18/2006	16,388.14	4,757.10
88-LOT0012	07/24/2006	50,125.98	06654	08/18/2006	611.48	177.50
97-LOT0012	11/07/2007	23,323.68	08457	12/06/2007	6,406.60	1,859.69
Z-LOT0012	05/29/2008	1,080.03	08E22	06/24/2008	40.88	11.87
				Total:	$24,635.55	$7,151.14

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

SUPERFUND TECH ASSESSMENT AND RESPONSE TEAM

Contractor Name: ROY F WESTON, INC.

EPA Contract Number: 68-W0-0113

Project Officer(s): ENG, HELEN

Dates of Service: From: 03/01/2006 To: 06/30/2006

Summary of Service: S/F TECH ASSESSMENT&RESPONSE TEAM (REDI)

Total Costs: $31,786.69

Voucher Number	Schedule Number	Rate Type	Annual Allocation Rate
82-LOT0011	06445	Class	0.290277
84-LOT0011	06513	Class	0.290277
88-LOT0011	06654	Class	0.290277
88-LOT0012	06654	Class	0.290277
97-LOT0012	08457	Class	0.290277
Z-LOT0012	08E22	Class	0.290277

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

SUPERFUND TECH ASSESSMENT AND RESPONSE TEAM - 3

Contractor Name: WESTON SOLUTIONS

EPA Contract Number: EPW06072

Delivery Order Information

DO #	Start Date	End Date
1	08/01/2006	06/30/2007
17	09/30/2010	06/30/2011
21	10/01/2010	12/31/2010
22	01/01/2011	01/31/2011

Project Officer(s): ENG, HELEN

Dates of Service: From: 08/01/2006 To: 06/30/2011

Summary of Service: S/F TECH ASSESSMENT&RESPONSE TEAM (REDI)

Total Costs: $82,104.45

Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number	and Date	Site Amount	Annual Allocation
2-LOT0001	09/19/2006	223,615.08	07A35	10/16/2006	2,169.15	292.86
5-LOT0001	10/18/2006	213,871.89	07B05	11/15/2006	1,726.52	233.10
9-LOT0001	11/28/2006	223,615.08	07C03	12/28/2006	386.89	52.23
13-LOT0001	12/13/2006	223,615.08	07C34	01/10/2007	256.97	34.69
15-LOT0001	01/16/2007	246,660.05	07D04	02/13/2007	997.21	134.64
15-LOT0002	01/16/2007	34,249.83	07D04	02/13/2007	4,305.00	581.23
18-LOT0001	02/08/2007	223,615.08	07D45	03/07/2007	294.23	39.72
21-LOT0001	03/09/2007	223,615.08	07E10	04/04/2007	286.85	38.73
43-LOT0002	09/12/2007	18,843.26	08149	10/10/2007	-911.05	-123.00
138-LOT0001	10/14/2010	281,851.50	01111	11/09/2010	10,428.28	1,407.94
138-LOT0002	10/14/2010	84,718.23	01111	11/09/2010	853.71	115.26
140-LOT0001	11/15/2010	241,471.60	01222	12/14/2010	10,904.69	1,472.26
140-LOT0002	11/15/2010	46,127.32	01222	12/14/2010	1,802.59	243.37
147-LOT0002	12/10/2010	6,215.43	11296	01/05/2011	6,215.43	839.16
149-LOT0001	12/15/2010	255,004.55	01322	01/13/2011	2,802.90	378.43
149-LOT0002	12/15/2010	78,220.78	01322	01/13/2011	9,837.86	1,328.22
155-LOT0001	01/14/2011	299,207.73	01418	02/11/2011	1,454.81	196.42
155-LOT0002	01/14/2011	146,730.16	01418	02/11/2011	12,052.95	1,627.29
162-LOT0002	01/14/2011	578.90	11418	02/11/2011	578.90	78.16
163-LOT0001	02/11/2011	244,049.30	01503	03/09/2011	880.21	118.84
166-LOT0002	02/11/2011	20,497.21	01503	03/09/2011	4,594.48	620.31

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

SUPERFUND TECH ASSESSMENT AND RESPONSE TEAM - 3

Contractor Name: WESTON SOLUTIONS

EPA Contract Number: EPW06072

Delivery Order Information

DO #	Start Date	End Date
1	08/01/2006	06/30/2007
17	09/30/2010	06/30/2011
21	10/01/2010	12/31/2010
22	01/01/2011	01/31/2011

Project Officer(s): ENG, HELEN

Dates of Service: From: 08/01/2006 To: 06/30/2011

Summary of Service: S/F TECH ASSESSMENT&RESPONSE TEAM (REDI)

Total Costs: $82,104.45

Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number and Date	Site Amount	Annual Allocation
185-LOT0001	07/18/2011	256,140.85	01A65 08/12/2011	419.39	56.62
			Total:	$72,337.97	$9,766.48

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Contract Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

SUPERFUND TECH ASSESSMENT AND RESPONSE TEAM - 3

Contractor Name: WESTON SOLUTIONS

EPA Contract Number: EPW06072

Delivery Order Information

DO #	Start Date	End Date
1	08/01/2006	06/30/2007
17	09/30/2010	06/30/2011
21	10/01/2010	12/31/2010
22	01/01/2011	01/31/2011

Project Officer(s): ENG, HELEN

Dates of Service: From: 08/01/2006 To: 06/30/2011

Summary of Service: S/F TECH ASSESSMENT&RESPONSE TEAM (REDI)

Total Costs: $82,104.45

Voucher Number	Schedule Number	Rate Type	Annual Allocation Rate
2-LOT0001	07A35	Class	0.135012
5-LOT0001	07B05	Class	0.135012
9-LOT0001	07C03	Class	0.135012
13-LOT0001	07C34	Class	0.135012
15-LOT0001	07D04	Class	0.135012
15-LOT0002	07D04	Class	0.135012
18-LOT0001	07D45	Class	0.135012
21-LOT0001	07E10	Class	0.135012
43-LOT0002	08149	Class	0.135012
138-LOT0001	01111	Class	0.135012
138-LOT0002	01111	Class	0.135012
140-LOT0001	01222	Class	0.135012
140-LOT0002	01222	Class	0.135012
147-LOT0002	11296	Class	0.135012
149-LOT0001	01322	Class	0.135012
149-LOT0002	01322	Class	0.135012
155-LOT0001	01418	Class	0.135012
155-LOT0002	01418	Class	0.135012
162-LOT0002	11418	Class	0.135012
163-LOT0001	01503	Class	0.135012
166-LOT0002	01503	Class	0.135012
185-LOT0001	01A65	Class	0.135012

Report Date: 03/29/2012

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Financial Cost Summary for the Contract Lab Program

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

CONTRACT LAB PROGRAM (CLP) COSTS

Report Date: 03/29/2012

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Miscellaneous (MIS) Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Miscellaneous (MIS) Costs

Total Costs: $48.61

Procurement Number	Voucher Number	Voucher Date	Voucher Amount	Treasury Schedule Number	and Date	Site Amount	Description
WEST GOVERNMENT SERVICES							
EP102000018	2200019415	06/22/2010	124.39	K2631	06/22/2010	48.61	
			Vendor Total:			**$48.61**	
			Total Miscellaneous Costs:			**$48.61**	

Report Date: 03/29/2012

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

Fiscal Year	Direct Costs	Indirect Rate(%)	Indirect Costs
2006	25,598.20	31.00%	7,935.44
2007	11,830.02	31.33%	3,706.36
2008	7,408.70	34.74%	2,573.79
2010	25,541.63	26.57%	6,786.42
2011	110,625.76	26.57%	29,393.27
2012	2,085.21	26.57%	554.04
	183,089.52		
Total EPA Indirect Costs			$50,949.32

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
CHONG, MARGARET	2006	20	1,913.05	31.00%	593.05
			1,913.05		$593.05
Total Fiscal Year 2006 Payroll Direct Costs:			1,913.05		$593.05

TRAVEL DIRECT COSTS

Traveler/Vendor Name	Travel Number	Treasury Schedule Date	Travel Costs	Ind. Rate (%)	Indirect Costs
CHONG, MARGARET	TM0436468	06/29/2006	217.50	31.00%	67.43
			217.50		$67.43
Total Fiscal Year 2006 Travel Direct Costs:			217.50		$67.43

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
68-W0-0113	82-LOT0011	05/12/2006	943.48	273.87	31.00%	377.38
	84-LOT0011	06/14/2006	244.97	71.11	31.00%	97.98
	88-LOT0012	08/18/2006	611.48	177.50	31.00%	244.58
	88-LOT0011	08/18/2006	16,388.14	4,757.10	31.00%	6,555.02
			18,188.07	5,279.58		$7,274.96
Total Fiscal Year 2006 Other Direct Costs:			18,188.07	5,279.58		$7,274.96
Total Fiscal Year 2006:			25,598.20			$7,935.44

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
EPW06072	2-LOT0001	10/16/2006	2,169.15	292.86	31.33%	771.35
	5-LOT0001	11/15/2006	1,726.52	233.10	31.33%	613.95
	9-LOT0001	12/28/2006	386.89	52.23	31.33%	137.58
	13-LOT0001	01/10/2007	256.97	34.69	31.33%	91.38
	15-LOT0002	02/13/2007	4,305.00	581.23	31.33%	1,530.86
	15-LOT0001	02/13/2007	997.21	134.64	31.33%	354.61
	18-LOT0001	03/07/2007	294.23	39.72	31.33%	104.63
	21-LOT0001	04/04/2007	286.85	38.73	31.33%	102.00
			10,422.82	1,407.20		$3,706.36
Total Fiscal Year 2007 Other Direct Costs:			10,422.82	1,407.20		$3,706.36
Total Fiscal Year 2007:				11,830.02		$3,706.36

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
COAKLEY, ROY W.	2008	08	123.71	34.74%	42.98
			123.71		$42.98
Total Fiscal Year 2008 Payroll Direct Costs:			123.71		$42.98

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
68-W0-0113	97-LOT0012	12/06/2007	458.39	133.06	34.74%	205.47
			5,948.21	1,726.63	34.74%	2,666.24
	Z-LOT0012	06/24/2008	34.66	10.06	34.74%	15.54

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
68-W0-0113	Z-LOT0012	06/24/2008	6.22	1.81	34.74%	2.79
			6,447.48	1,871.56		$2,890.04
EPW06072	43-LOT0002	10/10/2007	-911.05	-123.00	34.74%	-359.23
			-911.05	-123.00		$-359.23
Total Fiscal Year 2008 Other Direct Costs:			5,536.43	1,748.56		$2,530.81
Total Fiscal Year 2008:			7,408.70			$2,573.79

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
COAKLEY, ROY W.	2010	16	67.64	26.57%	17.97
			67.64		$17.97
DAVIS, ELIZABETH	2010	16	533.68	26.57%	141.80
			751.11	26.57%	199.57
		17	158.13	26.57%	42.02
		18	1,581.30	26.57%	420.15
			355.78	26.57%	94.53
		19	2,253.33	26.57%	598.71
		20	1,166.20	26.57%	309.86
		21	849.95	26.57%	225.83
		22	20.05	26.57%	5.33
			7,669.53		$2,037.80

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
HARKAY, JAMES D.	2010	12	232.55	26.57%	61.79
			232.55		$61.79
LEUNG, CHRISTINA	2010	25	1,942.33	26.57%	516.08
		26	3,659.18	26.57%	972.24
			5,601.51		$1,488.32
MUGDAN, WALTER E.	2010	12	49.01	26.57%	13.02
			49.01		$13.02
SHERIDAN, PATRICIA A.	2010	25	356.44	26.57%	94.71
		26	392.10	26.57%	104.18
			748.54		$198.89
SOLECKI, MICHAEL F.	2010	26	3,214.26	26.57%	854.03
			3,214.26		$854.03
TRUONO-WIGGETT, MARISSA	2010	14	65.81	26.57%	17.49
		16	1,020.02	26.57%	271.02
		17	131.61	26.57%	34.97
		18	98.73	26.57%	26.23
		19	67.64	26.57%	17.97
			1,383.81		$367.68

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
WILSON, ERIC	2010	12	76.33	26.57%	20.28
			76.33		$20.28
Total Fiscal Year 2010 Payroll Direct Costs:			19,043.18		$5,059.78

TRAVEL DIRECT COSTS

Traveler/Vendor Name	Travel Number	Treasury Schedule Date	Travel Costs	Ind. Rate (%)	Indirect Costs
DALOIA, JAMES J.	0QLKIP	06/14/2010	273.11	26.57%	72.57
			273.11		$72.57
DAVIS, ELIZABETH	0QLU3B	06/23/2010	194.50	26.57%	51.68
			194.50		$51.68
NACE, CHARLES G., JR.	0QLBDQ	07/01/2010	200.50	26.57%	53.27
			200.50		$53.27
SOLECKI, MICHAEL F.	0QLSGW	06/18/2010	224.11	26.57%	59.54
			224.11		$59.54
Total Fiscal Year 2010 Travel Direct Costs:			892.22		$237.06

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
EP102000018	2200019415	06/22/2010	48.61	0.00	26.57%	12.92
			48.61	0.00		$12.92
EPD05088	74	05/21/2010	533.98	9.17	26.57%	144.31
	75	06/25/2010	2,754.42	47.30	26.57%	744.42
	76	08/03/2010	475.83	8.17	26.57%	128.60
			342.24	5.88	26.57%	92.50
	77	08/18/2010	754.13	12.95	26.57%	203.81
	78	09/17/2010	603.19	10.36	26.57%	163.02
			5,463.79	93.83		$1,476.66
Total Fiscal Year 2010 Other Direct Costs:			5,512.40	93.83		$1,489.58
Total Fiscal Year 2010:			25,541.63			$6,786.42

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
BRANDON-BAZILE, KIM	2011	02	17.62	26.57%	4.68
			17.62		$4.68
CAPON, VIRGINIA F.	2011	17	268.58	26.57%	71.36
		21	47.49	26.57%	12.62
		24	569.86	26.57%	151.41
			885.93		$235.39
DAVIS, ELIZABETH	2011	04	75.56	26.57%	20.08
			113.35	26.57%	30.12
		07	39.67	26.57%	10.54

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
DAVIS, ELIZABETH	2011	12	278.14	26.57%	73.90
		14	298.01	26.57%	79.18
		15	99.33	26.57%	26.39
		16	814.54	26.57%	216.42
		17	2,463.51	26.57%	654.55
		18	1,551.08	26.57%	412.12
		19	571.45	26.57%	151.83
		20	61.22	26.57%	16.27
		21	1,530.65	26.57%	406.69
		22	820.65	26.57%	218.05
		23	1,326.57	26.57%	352.47
		24	1,653.12	26.57%	439.23
		25	367.36	26.57%	97.61
		26	346.95	26.57%	92.18
		27	101.79	26.57%	27.05
			12,512.95		$3,324.68
LEUNG, CHRISTINA	2011	01	214.53	26.57%	57.00
		02	1,083.28	26.57%	287.83
		03	3,284.81	26.57%	872.77
		04	377.28	26.57%	100.24
		18	218.00	26.57%	57.92
			5,177.90		$1,375.76
PRINCE, GEORGE R.	2011	03	3,629.74	26.57%	964.42
			3,629.74		$964.42
ROTOLA, JOSEPH D.	2011	20	194.99	26.57%	51.81
			194.99		$51.81
TRUONO-WIGGETT, MARISSA	2011	03	135.81	26.57%	36.08

Report Date: 03/29/2012

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
TRUONO-WIGGETT, MARISSA	2011	12	237.67	26.57%	63.15
		17	169.76	26.57%	45.11
			543.24		$144.34
WALL, STEVEN	2011	02	725.96	26.57%	192.89
			725.96		$192.89
WILSON, ERIC	2011	18	78.77	26.57%	20.93
		25	728.68	26.57%	193.61
		26	80.97	26.57%	21.51
			888.42		$236.05
Total Fiscal Year 2011 Payroll Direct Costs:			24,576.75		$6,530.02

TRAVEL DIRECT COSTS

Traveler/Vendor Name	Travel Number	Treasury Schedule Date	Travel Costs	Ind. Rate (%)	Indirect Costs
DALOIA, JAMES J.	0QZ5IY	10/01/2010	285.51	26.57%	75.86
	0R2ZC5	11/18/2010	416.50	26.57%	110.67
			702.01		$186.53
LEUNG, CHRISTINA	0R2QD9	01/03/2011	557.00	26.57%	148.00
			557.00		$148.00
PRINCE, GEORGE R.	0R1J1J	11/26/2010	1,174.36	26.57%	312.03
			1,174.36		$312.03

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

TRAVEL DIRECT COSTS

Traveler/Vendor Name	Travel Number	Treasury Schedule Date	Travel Costs	Ind. Rate (%)	Indirect Costs
SOLECKI, MICHAEL F.	0QX0IV	10/25/2010	519.74	26.57%	138.10
			519.74		$138.10
SOLECKI, MICHAEL F.	0R07EA	11/12/2010	451.69	26.57%	120.02
			451.69		$120.02
Total Fiscal Year 2011 Travel Direct Costs:			3,404.80		$904.68

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
EPD05088	79	10/19/2010	474.16	8.14	26.57%	128.15
			474.16	8.14		$128.15
EPW06072	138-LOT0002	11/09/2010	853.71	115.26	26.57%	257.46
	138-LOT0001	11/09/2010	10,428.28	1,407.94	26.57%	3,144.88
	140-LOT0002	12/14/2010	587.59	79.33	26.57%	177.20
			1,215.00	164.04	26.57%	366.41
	140-LOT0001	12/14/2010	10,904.69	1,472.26	26.57%	3,288.56
	147-LOT0002	01/05/2011	6,215.43	839.16	26.57%	1,874.40
	149-LOT0001	01/13/2011	2,802.90	378.43	26.57%	845.28
	149-LOT0002	01/13/2011	348.29	47.02	26.57%	105.03
			8,305.50	1,121.34	26.57%	2,504.71
			1,184.07	159.86	26.57%	357.08
	155-LOT0002	02/11/2011	292.95	39.55	26.57%	88.35
	155-LOT0001	02/11/2011	1,454.81	196.42	26.57%	438.73
	162-LOT0002	02/11/2011	578.90	78.16	26.57%	174.58
	155-LOT0002	02/11/2011	11,760.00	1,587.74	26.57%	3,546.49
	166-LOT0002	03/09/2011	4,594.48	620.31	26.57%	1,385.57
	163-LOT0001	03/09/2011	880.21	118.84	26.57%	265.45

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

OTHER DIRECT COSTS

Contract, IAG, SCA, Misc.NO	Voucher Number	Treasury Schedule Date	Site Amount	Annual/SMO Allocation Costs	Ind. Rate (%)	Indirect Costs
EPW06072	185-LOT0001	08/12/2011	419.39	56.62	26.57%	126.48
			62,826.20	8,482.28		$18,946.66
EPW09031	BVN0013	12/27/2010	6,401.13	0.00	26.57%	1,700.78
	BVN0014	01/28/2011	-6,401.13	0.00	26.57%	-1,700.78
			10,274.94	0.00	26.57%	2,730.05
	BVN0015	02/25/2011	552.04	0.00	26.57%	146.68
	BVN0019	06/21/2011	26.45	0.00	26.57%	7.03
			10,853.43	0.00		$2,883.76
Total Fiscal Year 2011 Other Direct Costs:			74,153.79	8,490.42		$21,958.57
Total Fiscal Year 2011:			110,625.76			$29,393.27

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
BERNS, CAROL Y.	2012	03	170.78	26.57%	45.38
			170.78		$45.38
DAVIS, ELIZABETH	2012	02	119.22	26.57%	31.68
		03	1,051.12	26.57%	279.28
		04	194.65	26.57%	51.72
		05	77.86	26.57%	20.69
			1,442.85		$383.37

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EPA Indirect Costs

W R GRACE, BRUTUS, NY, WEEDSPORT, NY SITE ID = 02 XM

All costs through 12/31/2011

PAYROLL DIRECT COSTS

Employee Name	Fiscal Year	Pay Period	Payroll Costs	Ind. Rate (%)	Indirect Costs
TRUONO-WIGGETT, MARISSA	2012	03	68.02	26.57%	18.07
			68.02		$18.07
WILSON, ERIC	2012	02	162.18	26.57%	43.09
		03	241.38	26.57%	64.13
			403.56		$107.22
Total Fiscal Year 2012 Payroll Direct Costs:			2,085.21		$554.04
Total Fiscal Year 2012:			2,085.21		$554.04
Total EPA Indirect Costs					$50,949.32

APPENDIX C

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NEW YORK 10007-1866

Removal Cost Estimate for WR Grace Superfund Site, Weedsport, NY

1. Installation and maintenance of a chain link security fence along the northern border of the Site near Dunn Road;
2. Excavation of all soil containing amphibole asbestos fibers (hereinafter collectively referred to as "asbestos fibers"), greater than or equal to 0.25%. Once the cleanup standard of less than 0.25% is achieved, activity-based sampling shall be conducted in the excavation area using a clearance standard of 0.01 fibers per cubic centimeter ("f/cc") in air to confirm that the cleanup level of 0.25% has been achieved;
3. Post-removal Site controls, including institutional controls, if determined to be necessary based on the results of the activity-based sampling if such sampling shows that the Site does not allow for unlimited use and unlimited exposure;
4. Building decontamination including cleaning the inside of the building and capturing all rinsate, if such rinsate is used (with proper off-Site disposal of rinse water), in order to remove asbestos fibers and materials containing such asbestos fibers from the building;
5. Post-decontamination clearance sampling to ensure that indoor air within the building meets risk-based criteria of 0.01 f/cc utilizing aggressive air sampling procedures and using methods specifically designed for counting asbestos structures classified as Phase Contrast Microscopy Equivalent fibers;
6. Proper characterization, transportation and off-Site disposal of the contaminated soil and any waste generated during building decontamination;
7. Post-excavation soil sampling and analysis at the Site to ensure the asbestos contamination in the soil is less than 0.25% in samples collected and analyzed using the methods described in the Administrative Order Index Number CERCLA-02-2012-2003; and
8. Backfilling of excavation areas and Site restoration;

EPA EXTRAMURAL COSTS (Emergency and Rapid Response Services Removal Support Team)	$2,550,000
EPA INTRAMURAL COSTS	$50,000
TOTAL EPA EXTRAMURAL & INTRAMURAL COSTS	$2,600,000
CONTINGENCY (20% of total extra/intramural costs rounded to the nearest thousand)	$520,000
SUBTOTAL	$3,120,000
INDIRECT COSTS (26.57%)	$828,984
TOTAL PROJECT	$ 3,948,984

APPENDIX D

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Standard Operating Procedures of CARB 435 Analysis

Bata Laboratories, Inc.

Rev. 1, Dec. 30, 2010

Statement: In all circumstances, if any part of this SOP is in contradiction to the publication of CARB 435 method, the later will dictate.

Reference: Sate of California Air Resources Board Method 435 (CARB 435): Determination of Asbestos Content of Serpentine Aggregate, June 6, 1991. See Attachment 1.

Synopsis: This SOP is an operable version of CARB 435 that is developed to take consideration of current laboratory practices and for various materials in testing. This SOP is written in accordance with CARB 435 and may also yield better accuracy for certain materials that are not covered in the original method. This SOP also adopted the option to use a higher magnification for counting fibers that would have not been able to resolve at the traditional 100x magnification as defined in the original CARB 435 method. This SOP applies to all materials that can be requested for CARB 435 analysis, including surface aggregates, pavements, concrete, soils, solid wastes, building materials, etc.

Safety: All milling and sample preparation should be conducted in a safe HEPA ventilation hood. A half-face respirator and a full Tyvek suit as the minimal protection.

Operating Procedures:

1. Sample Receiving, login, rejection, and disposal: Follow the guidelines in Quality Control/Quality Assurance Program for Bulk Asbestos Analysis, 4th Edition, 2008.
2. Sample Preparation: Follow guidelines in CARB 435 for sample mixing and grinding steps from pages 3-7. The following are key steps that need to be observed during preparation:
    1. Drying the sample if wet. The minimum drying time for a 9 oz moist sample is 24 hr. Longer time is needed according to the sample amount.
    2. Making aliquot for sample prep and analysis: always mix the sample well before dividing into four equal quadrants on a sheet of clean paper.
    3. Using play sand to clean the grinder between each sample.
    4. Hand milling is only applicable if called for by clients and/or on clay materials only to avoid clogging of the machine grinder.

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3. Sample Analysis: Follow the guidelines in section 8.0 of CARB 435 (pages 11-13) to proceed with the analysis with the following key steps to be carefully observed:
    1. Use 100x for preliminary quantitation of point counting.
    2. At the completion of 100x, always visually inspect under 400x. Define as Trace (or TR) when fibers are observed under 400x, but not under 100x.
    3. If a significant amount of fiber contents observed under 400x magnification, a 400-point should be performed following the CARB 435 point procedures. Define as Trace or TR if none of the fibers fall under the points.

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Attachment 1: CARB 435 Method

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California Environmental Protection Agency
AIR RESOURCES BOARD

Method 435

Determination of Asbestos Content of Serpentine Aggregate

Adopted: June 6, 1991

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Method 435

Determination of Asbestos Content of Serpentine Aggregate

1 PRINCIPLE AND APPLICABILITY

1.1 Principle

Asbestos fibers may be released from serpentine rock formations and are determined by microscopic techniques. The results are very sensitive to sampling procedures. The analytical results are reported in percent asbestos fibers which is the percent number of asbestos fibers contained in 400 randomly chosen particles of a bulk sample. Since the homogeneity of the material is unknown, the uncertainty in the sampling cannot be defined. The uncertainty of the analytical technique is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The derivation of this uncertainty value is explained in Section 7.4.

1.2 Applicability

This method is applicable to determining asbestos content of serpentine aggregate in storage piles, on conveyor belts, and on surfaces such as roads, shoulders, and parking lots.

2 DEFINITIONS

2.1 Bulk Sample

A sample of bulk material.

2.2 Grab Sample

A sample taken from a volume of material.

2.3 Composite Sample

A mixture or blend of material from more than one grab sample.

2.4 Serpentine

Serpentinite, serpentine rock or serpentine material.

2.5 Executive Officer

The term Executive Officer as used in this method shall mean the Executive Officer of the Air Resources Board (ARB) or Air Pollution Control

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Officer/Executive Officer of a local air pollution control district/air quality management district.

3 APPLICABLE SOURCES

This method can be used to obtain bulk material samples from three types of sources:

1. Serpentine aggregate storage piles
2. Serpentine aggregate conveyor belts
3. Serpentine aggregate covered surfaces

4 SAMPLING APPARATUS

4.1 Serpentine Aggregate Storage Piles

Tube insertion often provides the simplest method of aggregate material investigation and sampling. Insertion tubes shall be adequate to provide a relatively rapid continuous penetration force.

4.1.1 Thin-walled tubes should be manufactured as shown in Figure 1. The tube should have an outside diameter between 2 to 5 inches and be made of metal or plastic having adequate strength for penetration into aggregate piles. These tubes shall be clean and free of surface irregularities including projecting weld seams. Further information on these tubes can be found in Table 1 and ASTM D 1587-83, which is incorporated herein by reference.

4.1.2 The insertion tube can be made out of commercially available two inch PVC Schedule 40 pipe. Further information on the tube can be found in Table 2.

4.1.3 A round point shovel may be used.

4.2 Serpentine Aggregate Conveyor Belts

4.2.1 Sampling of aggregate off a conveyor belt requires a hand trowel, a small brush, and a dust pan.

4.2.2 Two templates as shown in Figure 2 are needed to isolate material on the conveyor belt.

4.2.3 An automated belt sampler may be used.

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4.3 Serpentine Aggregate Covered Surfaces

A shovel, a hand or machine-operated auger or other suitable equipment can be used to collect samples of aggregate materials on covered surfaces.

4.3.1 Hand-Operated Augers.

4.3.1.1 Helical Augers-Small lightweight augers such as spiral-type augers and ship-type augers may be used. A description of these augers can be found in ASTM D1452-80, which is incorporated herein by reference.

4.3.1.2 Orchard barrel and open spiral-type tubular augers may be used to collect samples. These augers range in size from 1.5 through 8 inches, and have the common characteristic of appearing essentially tubular when viewed from the digging end. Further description of these auger types can be found in ASTM D1452-80.

4.3.1.3 Clam Shell or Iwan-Type post-hole augers may be used to collect samples from surfaces generally 2 through 8 inches in diameter and have a common mean of blocking the escape of soil from the auger. Further description of these augers can be found in ASTM D1452-80.

4.3.2 Machine-Operated Augers

Machine-Operated Augers such as helical augers and stinger augers may be used. These augers are normally operated by heavy-duty, high-torque machines, designed for heavy construction work. Further description of these augers can be found in ASTM D1452-80.

4.3.3 A round point shovel can also be used to obtain a sample of aggregate covered surface material.

5 SAMPLING

The sampling procedure has been developed to provide an unbiased collection of bulk samples. A sampling plan, including a description of how the grab samples will be randomly collected and the number of samples to be collected, shall be developed. Prior to conducting any sampling the sampling plan shall be submitted to the Executive Officer for approval, if the sampling is conducted for determining compliance with a rule or regulation. The amount of composite 200 mesh material, as described below, shall be sufficient to provide a sample to the source or Executive Officer, if requested, and a sample to be archived for future use.

A single test as described below shall cover:

a) 1000 tons of aggregate for piles and conveyor belts, or

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b) one acre aggregate covered surface, or
c) one mile of aggregate covered road, or
d) two acres or two miles of dual aggregate covered shoulders.

Exposure to airborne asbestos fibers is a health hazard. Asbestos has been listed by the Governor as causing cancer and identified by the Air Resources Board as a toxic air contaminant. Serpentine aggregate may contain asbestos. Bulk samples collected can contain friable asbestos fibers and may release fibers during sampling, handling or crushing steps. Adequate safety precautions should be followed to minimize the inhalation of asbestos fibers. Crushing should be carried out in a ventilated hood with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in the inhalation of airborne asbestos fibers.

5.1 Serpentine Aggregate Storage Piles

Serpentine aggregate storage piles typically have a conical or a triangular prism shape. The aggregate is introduced at the top of the pile and is allowed to flow over the side. This action, called sloughing, causes a size segregation to occur with the finer material deposited towards the top of the pile.

The locations where grab samples will be taken are randomly chosen over the surface of the pile. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. For 1000 tons of product, a grab sample shall be taken at a minimum of three randomly chosen sampling locations. A minimum of three grab samples shall be taken even if the product pile contains less than 1000 tons of material. The slough is raked or shoveled away from the sampling location. A sampling apparatus is inserted one foot into the pile and the material is removed and is placed in an appropriate sized sampling container. Some of the possible sampling apparatus is discussed in Section 4.1. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material of which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label shall contain all the information described in Section 6 (except item 4).

5.2 Serpentine Aggregate Conveyor Belts.

Serpentine aggregate is transported from the rock crushing plant to a product stacking belt and finally to a storage pile or to a waiting truck for delivery to a buyer.

The grab samples shall be taken from the product stacking belt or if this is not possible then at the first transfer point before the stockpile. The grab samples shall be collected by stopping the belt a minimum of three times or using an automated sampler. The method of randomly choosing the sampling locations and intervals is left up to sampling personnel but must follow the procedure specified in the sampling plan. For 1000 tons of product, a grab sample is taken at a minimum of three randomly selected intervals. A minimum of three samples shall be taken even if the generated product is less than 1000 tons. Each time the belt is stopped to take a grab sample, templates, as shown in Figure 2, are placed a minimum of six inches apart to isolate the material on the belt. The material within the templates is removed with a small shovel or with a brush and a dust pan for the finer material and is placed in an appropriate sized sampling container. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80, which is incorporated herein by reference, shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority of which shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3 Serpentine Aggregate Covered Surfaces

5.3.1 Serpentine Aggregate Covered Roads

A serpentine aggregate-covered road shall be characterized by taking grab samples from a minimum of three randomly chosen locations per mile of road. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedures specified in the sampling plan. A minimum of three samples shall be taken even if the road is less than one mile long. Section 4.3 describes some of the possible sampling apparatus used to collect the grab samples. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80 shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.2 Serpentine Aggregate Covered Areas

A serpentine aggregate-covered play yard or parking lot shall be characterized by taking grab samples from a minimum of three randomly chosen locations per acre. The method of randomly choosing the sampling locations is left up to sampling personnel but must follow the procedure specified in the sampling plan. A minimum of three samples shall be taken even if the area is less than one acre. Section 4.3 describes some of the possible sampling apparatus for collecting the sample. Grab samples shall not contain underlying soils. Each of the grab samples shall be placed in the same sample container. This composited sample shall be crushed to produce a material with a nominal size of less than three-eighths of an inch. Before crushing, the sample must be adequately dried. ASTM Method C-702-80 shall be used to reduce the size of the crushed grab sample to a one pint aliquot. The one pint aliquot shall be further crushed using a Braun mill or equivalent to produce a material which the majority shall be less than 200 Tyler mesh. An aliquot of the 200 mesh material shall be put into a labeled sealed container. The label must contain all the information listed in Section 6 (except item 4).

5.3.3 Serpentine Aggregate Covered Road Shoulders

The sampling procedure specified in Section 5.3.1 or 5.3.2 shall be used for road shoulders covered with serpentine aggregate. The only difference is that a minimum of three grab samples shall be taken over a length of two miles of shoulder or over an area of two acres of shoulder surface. The word shoulder is meant to imply shoulders on both sides of the road. For serpentine aggregated covered shoulders, the sampling plan specified in Section 5 shall indicate whether the samples are collected on a two mile or two acre basis.

6 SAMPLING LOG

A sample log must be kept showing:

1) A unique sample number.
2) Facility name.
3) Facility address or location where sample is taken.
4) A rough sketch, video tape, or photograph of the specific sampling locations.
5) Date and time of sampling.
6) Name of person performing sampling.

7 ANALYTICAL PROCEDURE

7.1 Principle and Applicability

Samples of serpentine aggregate taken for asbestos identification are first examined for homogeneity and preliminary fiber identification at low magnification. Positive identification of suspect fibers is made by analysis of subsamples with the polarized light microscope.

The principles of optical mineralogy are well established.[2,3] A light microscope equipped with two polarizing filters coupled with dispersion staining is used to observe specific optical characteristics of a sample. The use of plane polarized light allows the determination of refractive indices along specific crystallographic axes. Morphology and color are also observed. A retardation plate is placed in the polarized light path for determination of the sign of elongation using orthoscopic illumination. Orientation of the two filters such that their vibration planes are perpendicular (crossed polars) allows observation of the birefringence and extinction characteristics of anisotropic particles.

Quantitative analysis involves the use of point counting. Point counting is a standard technique in petrography for determining the relative areas occupied by separate minerals in thin sections of rock. Background information on the use of point counting[3] and the interpretation of point count data[4] is available.

This method is applicable to all bulk samples of serpentine aggregate submitted for identification and quantification of asbestos components.

7.2 Range

The analytical method may be used for analysis of samples containing from 0 to 100 percent asbestos. The upper detection limit is 100 percent. The lower detection limit is 0.25 percent.

7.3 Interferences

Fibrous organic and inorganic constituents of bulk samples may interfere with the identification and quantitation of the asbestos content. Fine particles of other materials may also adhere to fibers to an extent sufficient to cause confusion in the identification.

7.4 Analytical Uncertainty

The uncertainty method is two percent if twenty asbestos fibers are counted in a sample of 400 particles. The uncertainty of the analytical method may be assessed by a 95% confidence interval for the true percentage of asbestos fibers in the rock. The number of asbestos fibers in the sample is assumed to have a

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binomial distribution. If twenty asbestos fibers are found in a sample of 400 particles, a one-sided confidence interval for the true percentage has an upper bound of seven percent or an analytical uncertainty of two percent.[11] The confidence interval used here is an "exact" interval computed directly from the binomial distribution.

7.5 Apparatus

7.5.1 Microscope

A low-power binocular microscope, preferably stereoscopic, is used to examine the bulk sample as received.

* Microscope: binocular, 10-45X
* Light Source: incandescent, fluorescent, halogen or fiber optic
* Forceps, Dissecting Needles, and Probes
* Glassine Paper, Clean Glass Plate, or Petri dish
* Compound microscope requirements: A polarized light microscope complete with polarizer, analyzer, port for wave retardation plate, 360° graduated rotating stage, substage condenser, lamp, and lamp iris
* Polarized Light Microscope: described above
* Objective Lenses: 10X
* Dispersion Staining Objective Lens: 10X
* Ocular Lens: 10X
* Eyepiece Reticule: 25 point or 100 point Chalkley Point Array or cross-hair
* Compensator Plate: 550 millimicron retardation
* First Order Red I Compensator: 530 nanometers

7.6 Reagents

Refractive Index Liquids: 1.490 - 1.570, 1.590 - 1.720 in increments of 0.002 or 0.004.

Refractive Index Liquids for Dispersion Staining: High-dispersion series, 1.550, 1.605, 1.630 (optional).

UICC Asbestos Reference Sample Set: Available from UICC MRC Pneumoconiosis Unit, Lisndough Hospital Penarth, Glamorgan CF6 1xw, UK and commercial distributors.

Tremolite-asbestos: Available from J. T. Baker.

Actinolite-asbestos: Available from J. T. Baker.

Chrysotile, Amosite, and Crocidolite is available from the National Institute of Standards and Technology.

Anthophyllite, Tremolite, Actinolite will be available from the National Institute of Standards and Technology during the first quarter of 1990.

8 PROCEDURES

Exposure to airborne asbestos fibers is a health hazard. Bulk samples submitted for analysis are usually friable and may release fibers during handling or matrix reduction steps. All samples and slide preparations should be carried out in a ventilated hood or glove box with continuous airflow (negative pressure) exhausting through an HEPA filter. Handling of samples without these precautions may result in exposure of the analyst and contamination of samples by airborne fibers.

8.1 Sample Preparation

An aliquot of bulk material is removed from the one pint sample container. The aliquot is spread out on a glass slide. A drop of staining solution with appropriate refractive index is added to the aliquot. A cover slide is placed on top of the sample slide.

The first preparation should use the refractive index solution for Chrysotile. If during the identification phase other asbestiforms are suspected to be present in the sample, due to their morphology, then additional analyses shall be performed with the appropriate solutions. Report the percentages of each asbestiform and combine percentages to determine total asbestos concentrations.

8.2 Fiber Identification

Positive identification of asbestos requires the determination of the following optical properties:

Morphology (3 to 1 minimum aspect ratio)
Color and pleochroism

Refractive indices
Birefringence
Extinction characteristics
Sign of elongation

Table 3 lists the above properties for commercial asbestos fibers. Natural variations in the conditions under which deposits of asbestiform minerals are formed will occasionally produce exceptions to the published values and differences from the UICC standards. The sign of elongation is determined by use of the compensator plate and crossed polars. Refractive indices may be determined by the Becke line test. Becke line test or dispersion staining shall be used to identify asbestos fibers. Central stop dispersion staining colors are presented in Table 4. Available high-dispersion (HD) liquids should be used.

8.3 Quantification of Asbestos Content

Asbestos quantification is performed by a point-counting procedure. An ocular reticle (point array) or cross-hair is used to visually superimpose points on the microscope field of view. The point counting rules are as follows:

1. Record the number of points positioned directly above each particle or fiber.
2. Record only one point if two points are positioned over same particle or fiber.
3. Record the number of points positioned on the edge of a particle or fiber.
4. If an asbestos fiber and a matrix particle overlap so that a point is superimposed on their visual intersection, a point is scored for both categories.
5. If a test point lies over an ambiguous structure, no particle or fiber is recorded. Examples of "ambiguous" structures are:
   a) fibers whose dispersion colors are difficult to see
   b) structures too small to categorize
6. A fiber mat or bundle is counted as one fiber.

For the purpose of the method, "asbestos fibers" are defined as mineral fibers having an aspect ratio greater than 3:1 and being positively identified as one of the minerals in Table 3.

A total of 400 points superimposed on either asbestos fibers or nonasbestos matrix material must be counted over at least eight different preparations of representative subsamples. Take eight forceps samples and mount each

separately with the appropriate refractive index liquid. The preparation should not be heavily loaded. The sample should be uniformly dispersed to avoid overlapping particles and allow 25 - 50 percent empty area within the fields of view. Count 50 nonempty points on each preparation, using either

A reticle with 100 points (Chalkley Point Array) and counting 25 points in at least two randomly selected fields.

or

A reticle with 25 points (Chalkley Point Array) and counting at least two randomly selected fields.

or

A reticle with a standard cross-hair and counting at least 50 randomly selected fields.

For samples with mixtures of isotropic and anisotropic materials present, viewing the sample with slightly uncrossed polars or the addition of the compensator plate to the polarized light path will allow simultaneous discrimination of both particle types. Quantitation should be performed at 100X. Confirmation of the quantitation result by a second analyst on 10 percent of the analyzed samples should be used as standard quality control procedure. All optical properties in Section 8.2 shall be determined to positively identify asbestos.

EXCEPTION I

If the sample is suspected of containing no asbestos a visual technique can be used to report that the sample does not contain asbestos. The rules are as follows:

1. Prepare three slides as described in Section 8.3.

2. View 10 fields per preparation. Identify all fibers.

3. If all fibers are nonasbestos, report no asbestos were found and that visual technique was used.

4. If one fiber is determined to be asbestos, discontinue the visual method and perform the point counting technique as described above.

EXCEPTION II

If the sample is suspected to have an asbestos content in excess of ten percent, a visual technique can be used to report that the sample contains greater than

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ten percent asbestos. The standard operating procedure of the visual technique allowed in the National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program, Bulk Asbestos Handbook, National Institute of Standards and Technology publication number NISTIR 88-3879 dated October 1988, which is incorporated herein by reference, shall be followed.

9.0 CALCULATIONS

The percent asbestos is calculated as follows:

% asbestos = (a/n) 100%

a = number of asbestos counts,
n = number of nonempty points counted (400)

If a = 0, report "No asbestos detected"
If a > 0, report the calculated value to the nearest 0.25%

If "no asbestos detected" is reported by the point counting technique, the analyst may report the observation of asbestos fibers in the non-counted portions of the sample.

10.0 ALTERNATIVE METHODS

10.1 Alternative Sampling Methods

Alternate sampling methods may be used as long as they are substantially equivalent to the sampling methods discussed in Section 5 and approved by the Executive Officer of the Air Resources Board. The ARB Executive Officer may require the submittal of test data or other information to demonstrate equivalency.

10.2 Analytical Methods

An alternative analytical method may be used as long as it produces results substantially equivalent to the results produced by the point counting method and approved by the Executive Officer of the Air Resources Board. The ARB Executive Officer may require the submittal of test data or other information to demonstrate equivalency.

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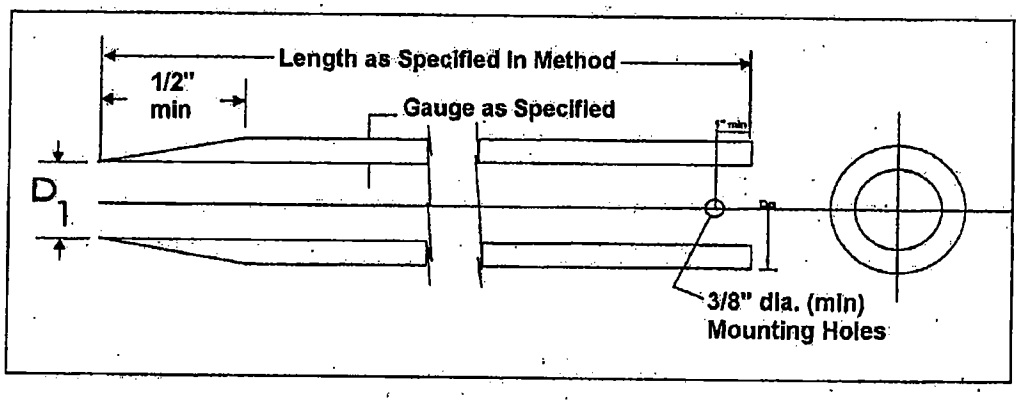
Figure 1

Thin Wall Tube for Sampling



Note 1 Minimum of two mounting holes on opposite sides for 2 to 3 inch diameter sampler.

Note 2 Minimum of four mounting holes spaced at 90° for samplers 4 inch diameter and larger.

Note 3 Tube held with hardened screws.

Note 4 Two inch outside-diameter tubes are specified with an 18-gauge wall thickness to comply with area ratio criteria accepted for "undisturbed samples." Users are advised that such tubing is difficult to locate and can be extremely expensive in small quantities. Sixteen-gauge tubes are generally readily available.

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Table 1

Suitable Thin Walled Steel Sample Tube[A]

OUTSIDE DIAMETER:			
inches	2	3	5
millimeters	50.8	76.2	127
WALL THICKNESS:			
Bwg	18	16	11
inches	0.049	0.065	0.120
millimeters	1.24	1.65	3.05
TUBE LENGTH:			
inches	36	36	54
meters	0.91	0.91	1.45
CLEARANCE RATIO, %	1	1	1

[A] The three diameters recommended in Table 1 are indicated for purposes of standardization, and are not intended to indicate that sampling tubes of intermediate or larger diameters are not acceptable. Lengths of tubes shown are illustrative. Proper lengths to be determined as suited to field conditions.

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Table 2

Dimensional Tolerances for Thin Walled Tubes

Nominal Tube Diameters from Table 1[A] Tolerances, inches

Size Outside Diameter	2	3	4
Outside Diameter	+0.007 -0.000	+0.010 -0.000	+0.015 -0.000
Inside Diameter	+0.000 -0.007	+0.000 -0.010	+0.000 -0.015
Wall Thickness	+0.007	+0.010	+0.015
Ovality	0.015	0.020	0.030
Straightness	0.030/ft	0.030/ft	0.030/ft

[A] Intermediate or larger diameters should be proportional. Tolerances shown are essentially standard commercial manufacturing tolerances for seamless steel mechanical tubing. Specify only two of the first three tolerances; O. D. and I. D. or O. D. and Wall, or I. D. and Wall.

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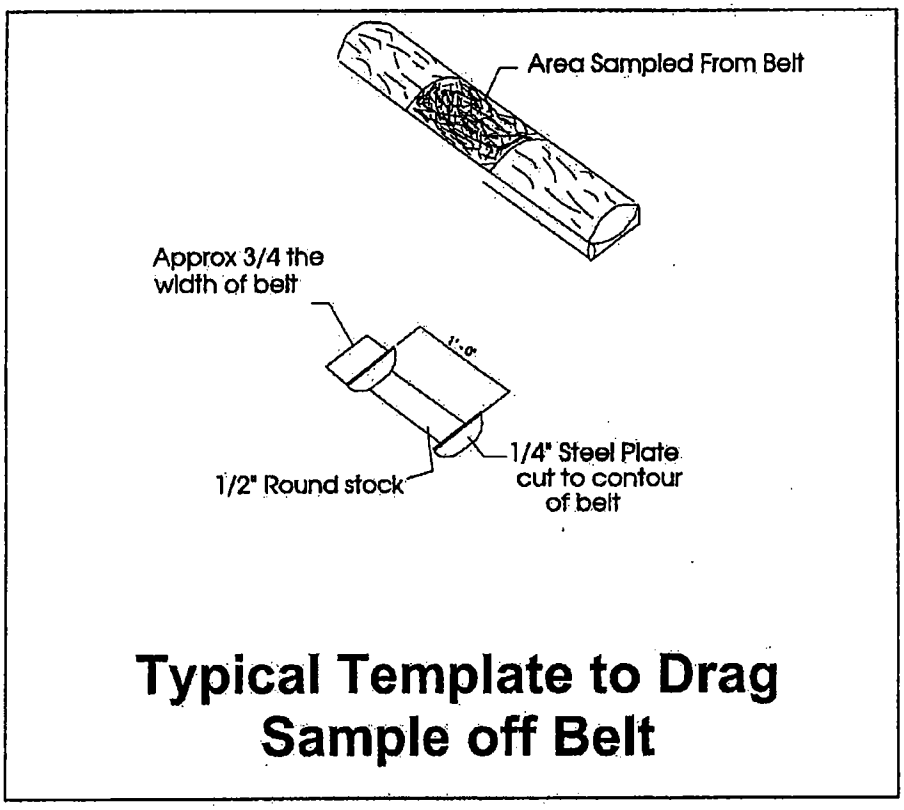
Figure 2



Typical Template to Drag Sample off Belt

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Table 3

Optical Properties of Asbestos Fibers

Mineral	Morphology[a], color	Refractive Indices[b] alpha	Refractive Indices[b] gamma	Birefringence	Extinction	Sign of Elongation
Chrysotile (asbestiform serpentine)	Wavy fibers. Fiber bundles have splayed ends and "kinks." Aspect ratio typically >10:1. Colorless[c], nonpleochroic.	1.493 - 1.560	1.517 - 1.562[f] (normally 1.556)	0.002 - 0.014	|| to fiber length	+ (length slow)
Amosite (asbestiform grunerite)	Straight, rigid fibers. Aspect ratio typically >10:1. Colorless to brown, nonpleochroic or weakly so. Opaque inclusions may be present.	1.635 - 1.696	1.655 - 1.729[f] (normally 1.696 - 1.710)	0.020 - 0.33	|| to fiber length	+ (length slow)
Crocidolite (asbestiform riebeckite)	Straight, rigid fibers. Thick fibers and bundles common, blue to purple-blue in color. Pleochroic. Birefringence is generally masked by blue color.	1.654 - 1.701	1.668 - 1.717 (normally close to 1.700)	0.014 - 0.016	|| to fiber length	- (length fast)
Anthophyllite-asbestos	Straight fibers and fiber bundles showing splayed ends. Colorless to light brown. Pleochroism absent.	1.596 - 1.652	1.615 - 1.676[f]	0.019 - 0.024	|| to fiber length	+ (length slow)
Tremolite-actinolite-asbestos	Straight and curved fibers and fiber bundles. Large bundles show splayed ends. Tremolite is colorless and actinolite is green. Weakly to moderately pleochroic.	1.599 - 1.668	1.622 - 1.688[f]	0.023 - 0.020	|| to fiber length	+ (length slow)

[a] From Reference 6; colors cited are seen by observation with plane polarized light.
[b] From References 7 and 9.
[c] Fibers subjected to heating may be brownish.
[d] Fibers defined as having aspect ratio >3:1.
[e] to fiber length.
[f] || to fiber length.

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Table 4

Central Stop Dispersion Staining Colors[a]

Mineral	RI Liquid	nu |	nu ||
Chrysotile	1.550HD	blue	blue-magenta
Amosite	1.680	blue-magenta to pale blue	golden-yellow
	1.550HD	yellow to white	yellow to white
Crocidolite[b]	1.700	red-magenta	blue-magenta
	1.550HD	yellow to white	yellow to white
Anthophyllite	1.605HD	blue	gold to gold-magenta
Tremolite	1.605HD[c]	pale blue	yellow
Actinolite	1.630HD	gold-magenta to blue	gold
	1.630HD[c]	magenta	golden-yellow

[a] From Reference 10.

[b] Blue absorption color.

[c] Oblique extinction view.